DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. **Claims 1** and **16** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chow (US 6771966 B1, hereinafter Chow) in view of Ayyagari et al. (US 20020101822, hereinafter Ayyagari), further in view of Steer et al. (US 20040157613 A 1, hereinafter Steer).

For **claims 1** and **16**, Chow discloses a method and a computer-readable storage medium, which does not consist of a modulated data signal (the computer memory used to store instructions for implementing the method) for determining placement locations of access points in network (determining and providing "node site information", col. 20, line 61-62 and FIG. 12, including adding new nodes to networks as shown in FIG. 17 in view of "multiple such *distributing node* sites may be *deployed* in some or all such service regions, if desired", col. 31, lines 11-13), comprising:

(a) accepting connectivity information for the network (accepting "node site information provided", col. 20, line 61-62 in view of FIG. 7), the network being a multi-hop wireless mesh network employing a MAC protocol (MAC sub-layer of nodes in the network as every node in a radio network has a MAC sub-layer, and all MAC sub-layer

are connection-based with radio links, as shown by the network in FIG. 17) and comprising nodes and links between the nodes, the connectivity information (FIG. 7, shows the connectivity information of existing nodes and links [solid lines]), each access point in the set of prospective access locations (suggested by “node site information provided”, col. 20, line 61-62 in view of FIG. 7; or “This system and method should identify the radio frequency plan efficiently. Further a need exists for the *location of the desired sites* to be freely located within a service region”, col. 3, lines 3-5);

(b) perform acts of:

(i) iterating through each access point in the set of prospective access locations (“the iterative process is repeated until the engineer is satisfied with the layout", col. 9, lines 66-67; or “provide for the *desired location* of links”, col. 1, lines 64-66):

(I) selecting an test access point, from the set of prospective access locations to be opened (selecting links, col. 10, line 64; or “a potentially usable subset of all possible links”, col. 3, lines 43-44), to be added to a set of currently open Access points (“installed node sites and future node sites”, col. 5, lines 44-46; or “an upcoming node site category and a potential node site category”, col. 5, lines 51-60); and

(II) computing node demands satisfied if the test access point is added the set of currently open Access points (“computations are run again to determine the overall characteristics of the radio topology”, col. 9, line 64-66; where topology include ACCESS POINT as node);

(ii) selecting, as a new access point for the network (suggested by "to provide the best set of ratio links or radio topology once the nodes and radio sites have been identified", col. 9, lines 48-49; and "new links may be established", col. 9, Line 29; which suggests new nodes and links may be added at the selected locations to provide best service), the test access point from the set of prospective access locations having a maximum computed value of the node demands satisfied (such as "maximum *number* of radio links at a node site", col. 8, line 37-39, in view of FIG. 15; or) when opened together with Access points in the set of currently open Access points (make selection iteration criterion as maximum computed value using the iterative process described in col. 9, lines 66-67);

(iii) adding the selected new access point to the set of currently open access points (suggested by "to provide *the best set* of radio links or radio topology …", col. 9, lines 48-60); and

(iv) repeating the iterating, selecting, and adding until all the node demands are satisfied ("to provide the best set of radio links or radio topology … repeated until … is satisfied", col. 9, lines 48-67); and

(c) implementing each access point in the set of currently opened Access points in the network at its respective placement location (for each desired location of the access point in the set of the selected nodes, implementing by the iterating process above).

Chow does not explicitly disclose that the MAC is the contention-based MAC.

In the same field of endeavor, Ayyagari et al. (US 20020101822) discloses Ethernet ([0005]) that has a the contention-based MAC based on IEEE 802.3, which is also used by most wireless communication protocols. Ayyagari further discloses that a wireless network comprises multiple nodes and links (wireless network shown in Fig. 3 or in Fig. 7) whose connectivity information comprises link capacity constraints ("link's capacity", [0058]), node capacity constraints ("the capacity allocated to each node", [0025]), and node demands for flow ("node demands a higher share of the bandwidth", [0071]); One skilled in the art would apply the access point placement method disclosed by Chow to the multi-hob wireless network disclosed by Ayyagari as suggested by Chow in claim 1 for the benefit of achieving minimized interference (col. 3, line 20-24 of Chow).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use contention-based MAC and the performance and capacity analysis techniques disclosed by Ayyagari in the access point placement planning disclosed by Chow to ensure the planned network to have sufficient performance and capacity to meet desired requirement.

Chow in view of Ayyagari does not specifically disclose adding and selecting new nodes as the potential access points.

Steer discloses adding new nodes and alternative links connectivity information in calculating the overall performance of the network ("to determine what frequency or frequencies are best for selection for a link from an wireless network node to a neighboring wireless network node, *a new node* seeking to establish a route to a

network access node or a node seeking to improve its route to the network access node must determine information about the current network topology and frequency us", [0030]). In fact, Chow also implicitly discloses the location of the new nodes in col. 5, lines 42-49, "By including not only the installed node sites in the link analysis but also the future node sites, the links which are currently established may *be adapted to easily accept the addition of links of the future node sites* as demand increases", noting that future node sites are the locations of the new node,

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to apply the teaching of Steer above to the performance and capacity analysis disclosed by Chow in view of Ayyagari to ensure the planned network to have sufficient performance and capacity for the network service.

3. **Claims 3** and **10** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chow in view of Ayyagari and Steer, further in view of Bush et al. (US 2004/0250128 A1, hereinafter Bush).

As to **claim 3** and **10**, Chow in view of Ayyagari and Steer discloses the method of claim 1 and 8, Chow further teaches computing the node demands satisfied if the access point is added to the set of currently open access points ("to provide the best set of ratio links or radio topology once the nodes and radio sites have been identified", col. 9, lines 48-49; which suggested add new nodes to current network when necessary) comprises:

creating a subgraph induced on a set of nodes (any subgraph of graph shown in Fig. 7), a set of currently opened Access points (solid nodes in Fig. 7), and a test access point (705 of Fig. 7);

adding a source node, the source node having edges of capacity equal to the demand of the transformed node from the source to each node in the network; adding a destination node, the destination node having edges of capacity equal to the capacity of each currently opened access point and the potential access point to be opened, from each currently opened access point and the potential access point to be opened to the destination node ("By including not only the installed node sites in the link analysis but also the future node sites, the links which are currently established may *be adapted to easily accept the addition of links of the future node sites* as demand increases", col. 5, lines 42-49, note that future node sites are the locations of the new node).

Chow in view of Ayyagari and Steer is **silent on** formulating a max-flow problem, wherein the max-flow problem computes the amount of node demands that can be satisfied under a given set of opened Access points when network throughput is independent of network path length; transforming each node's capacity constraint to an edge capacity constraint by replacing each node with a first node and a second node, the first node accepting all incoming edges to the transformed node and all outgoing edges from the transformed node originating from the second node, and creating a directed edge, having the node's capacity, from the first node to the second node; and computing the maximum flow from the source node to the destination node.

Bush teaches using directed graph for network analysis with each access point considered as a node and a directed edge between two nodes being considered as directed traffic flow capacity constraint with throughput is independent of network path length (“in FIG. 3 a directed graph is created for a network”, [0036] in view of FIG. 3), forming a directed subgraph based on a given set of access points, and formulating a traffic capacity modeling (FIG. 3, shows a network comprising nodes and links as a directed graph, with length of edge is irrelevant to link throughput), and computing max-flow based on the modeling (maximum flow analysis, [0040], line 1-2).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chow in view of Ayyagari and Steer with Bush in using directed subgraph to model a network for computing the max-flow of the network in order to use network efficiently.

4. **Claims 4, 7-8, 11** and **14-15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chow view of Ayyagari and Steer, further in view of Matsunaga et al. (US 5,440,675, hereinafter Matsunaga).

As to **claim 4**, Chow view of Ayyagari and Steer discloses the method of claim 1, wherein the computing the node demands satisfied if the access point is added to the set of currently open Access points (“to provide the best set of ratio links or radio topology once the nodes and radio sites have been identified”, col. 9, lines 48-49; which suggested add new nodes to current network when necessary), but is silent on using the linear programming method to compute maximum flow the network.

In the same field of endeavor, Matsunaga discloses using linear programming to compute maximum flow a network (“to analyze and solve the allocation of resources, scheduling or the *maximum flow* which can be represented by a network, there have been methods using a graphic theory and a *linear programming* method”, col. 1, line 18-21), wherein the linear program treats throughput of a connection as independent of path length (a network model shown in FIG. 7(a)-7(e), which indicates that the throughput is independent of path length, instead, it depends on the weight of the edge); modifying the linear program to ensure that flow from each node is served by independent paths (FIG. 14 shows the independent paths in the network; an independent path is interpreted as an path with a traffic capacity); modifying the linear program to multiply the node demand by the number of independent paths (iteration in “simplex method” for solving linear programming, col. 1, line 37-43 involves modifying the parameters of the linear programming equations for the network based on the nodes and links of the network; note that Specification does not provide details of multiplying the node demand by the number of independent paths, it is interpreted as best understood); modifying the linear program to multiply the capacity constraints by a ratio of an over-provisioning factor to the number of independent paths (iteration in “simplex method” for solving linear programming, col. 1, line 37-43 involves modifying the parameters of the linear programming equations for the network; note that Specification does not provide details of multiplying the capacity constraints by a ratio of an over-provisioning factor to the number of independent paths, it is interpreted as best understood); and solving the resulting linear program (“according to the linear

programming method, the relationship between the inflow and outflow in the whole network or at each node, and the restrictions of the flow rate, etc. at each branch and a corresponding objective function are analyzed by a simplex method revealed in "Guide to Linear Programming Method" (1980)", col. 1, line 37-43, the simplex method solves the resulting linear program).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chow view of Ayyagari and Steer with Matsunaga for computing the max-flow of the network in order to use network efficiently.

As to **claim 7**, Chow view of Ayyagari and Steer discloses the method of claim 1 wherein the wherein the computing the node demands satisfied if the access point is added to the set of currently open Access points comprises:

developing a linear program to compute maximum demands satisfied in the wireless neighborhood network by opening the selected access point in conjunction with the set of currently opened Access points, wherein the linear program treats throughput of a connection as a function of a number of hops the connection traverses ([0003]);

denoting an amount of flow routed through an edge based on a position of the edge along a path;

modifying the linear program to limit the maximum flow from each node; and

solving the resulting linear program.

However, the above limitations are common procedure of solving a max-flow problem ([0040], line 8-9) using linear programming, which is well known to persons skilled in the art as suggested by Lee ([0040], line 8-14).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chow view of Ayyagari and Steer with Lee for computing the max-flow of the network in order to use network efficiently.

As to **claim 8**, Chow view of Ayyagari and Steer discloses the method of claim 1 wherein the wherein the computing the node demands satisfied if the access point is added to the set of currently open Access points comprises:

developing a linear program to compute maximum demands satisfied in the wireless neighborhood network by opening the selected access point in conjunction with the set of currently opened Access points, wherein the linear program treats throughput of a connection as a function of a number of hops the connection traverses;

modifying the linear program to ensure that flow from each node is served by independent paths (e.g., [0066]);

modifying the linear program to multiply the node demand by the number of independent paths (e.g., [0066]);

modifying the linear program to multiply the capacity constraints by a ratio of an over-provisioning factor to the number of independent paths (e.g., [0098]); and

solving the resulting linear program.

However, the above limitations are typical techniques of applying common procedure of solving a max-flow problem using linear programming, which is well known to persons skilled in the art as suggested by Lee ([0040], line 8-14)

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chow view of Ayyagari and Steer with Lee for computing the max-flow of the network in order to use network efficiently.

As to **claims 11** and **14-15**, they are rejected for the same reasons as explained in claims 4 and 7-8, respectively because claims 4 and 7-8 include all limitations of claims 11 and 14-15.

5. **Claims 5-6** and **12-13** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chow view of Ayyagari and Steer, further in view of McGlade.

As to **claims 5** and **12**, Chow view of Ayyagari and Steer discloses the method of claim 1 and 16, wherein the computing the node demands satisfied if the access point is added to the set of currently open Access points (suggested by “to provide the best set of ratio links or radio topology once the nodes and radio sites have been identified”, col. 9, lines 48-49; and “new links may be established”, col. 9, Line 29; which suggests new nodes and links may be added at the selected locations to provide best service);

Chow view of Ayyagari and Steer is silent on finding the shortest path from demand points to opened Access points; routing one unit of flow along the shortest path; decreasing capacities of edges on the path by one; and repeating the finding, routing, and decreasing until the shortest path found has a length greater than a hop-count bound.

McGlade teaches finding a shortest path (“by shortest path”, Col. 13, line 1-6; note that the path distance is measured in hops, as disclosed by “This distance, measured in hops”, Col. 13, line 2-3). Since an access point can either be considered

as a node, the technique of finding a shortest path in general networks can be applied to networks with Access points.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chow with McGlade for computing the max-flow of the network in order to use network efficiently.

As to **claims 6** and **13**, Chow view of Ayyagari and Steer discloses the method of claim 1 and 16, wherein the wherein the computing the node demands satisfied if the access point is added to the set of currently open Access points (suggested by “to provide the best set of ratio links or radio topology once the nodes and radio sites have been identified”, col. 9, lines 48-49; and “new links may be established”, col. 9, Line 29; which suggests new nodes and links may be added at the selected locations to provide best service);

Chow view of Ayyagari and Steer is silent on finding a shortest path from demand points to opened Access points; routing one unit of flow along the shortest path; decreasing capacities of edges on the path by one; repeating the finding, routing, and decreasing until no path between any demand point and any open access point remains; and computing a demand satisfied along each path according to a throughput function.

McGlade teaches finding the shortest path (“by shortest path”, Col. 13, line 1-6; note that the path distance is measured in hops, as disclosed by “This distance, measured in hops”, Col. 13, line 2-3) and computing the max flow (suggested by “the max flow phase routes”, Col. 17, line18-20; or “FIG. 14 provides … max flow”) along the

path. Since an access point can either be considered as a node, or as a part of a node, the technique of finding a shortest path in general networks can be applied to networks with Access points.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chow with McGlade to use the shortest path and to allow the max-flow of the network in order to use network efficiently.

6. **Claims 17-18, 19-20** and **28** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chow view of Ayyagari and Steer, further in view of Layson et al. (US 6,405,213 B1, hereinafter Layson).

For **claims 17-18, 19-20** and **28**, they are the claims similar to corresponding claim 1 and 16 (note that in claim 17-18 and 20, access points and nodes are used corresponding to Access points, they are nodes interpreted as Access points since they are not defined in Specification and have same functions as Access points), with the iteration performed on a set of time intervals.

Chow view of Ayyagari and Steer discloses claim 1 and 16, does not explicitly disclose iterating through a set of time intervals.

In the same field of endeavor (wireless communication), Layson discloses iteration over time interval ("an iterative process where the time interval for each iteration", col. 16, lines 50-52). From mathematical point of view, iterating process may use any set of parameters for iteration, including the time interval in additional to network parameters such as links and nodes.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to Chow view of Ayyagari and Steer with Layson to iterate over time intervals for optimization.

Allowable Subject Matter

7. Claims 23-25 are allowed.

Response to Amendments/Remarks

8. Applicant's arguments and all other documents filed on 1/13/12 have been fully considered, but are not persuasive.

9. Independent claims, Applicant makes the following arguments.

Reason #1) Applicant argues "In Chow … regardless the type of node, *the location is known and does not change* during the link determination process … The potential node location are clearly not selected using the claimed access point location determination features" (page 4-5), which is opposite to "the Examiner states just the opposite" in that "the identified group of network node sites analyzed according to the present invention includes at least two categories for grouping the network nodes sites; the installed node sites and future node sites" (page 5).

In response, **Examiner respectfully disagrees**. The fact that the node sites are determined and do not change during the calculation/determination process does not contradict to the fact the selected node sites used in the calculation/determination process can be chosen from two groups of the network nodes sites: the installed node sites and future node sites. Both facts are correct and there is no contradiction.

Reason #2) Applicant argues “Thus, the cited statement in Chow refers to an engineer picking, evaluating and eliminating unacceptable links between the node locations. It has nothing to do with iterating through potential access point location, as claimed by the applicants”.

In response, **Examiner respectfully disagrees**. The cited engineer picking refers to the outcome of the calculation/determination process. In other word, calculation/determination process continues iteratively until a layout of the selected nodes that satisfies the given criteria is found wherein the location of each of the selected nodes is determined.

Reason #3) Applicant argues “These node site locations *must be known* before the analysis begins”, implying the location of the each selected node cannot be changed during the calculation/determining process.

In response, **Examiner respectfully disagrees**. There is no support in Chow for making such assertion. In fact changing the locations of nodes yield different link characteristic, which helps eventually finding a layout that satisfies the given criteria.

Reason #4) Applicant argues selecting links between nodes in not the same as selecting an access point.

In response, cited reference such as Chow teaches selecting links throughout the specification, such as in FIG. 2-12. Links is also suggested by "radio topology” (col. 9, lines 64-66) as acknowledged by Applicant.

Reason #5) Applicant argues the radio topology referred to in Chow is restricted to link configuration among nodes having a fixed location as Chow recites “once the nodes and radio sites have been identified”.

In response, **Examiner respectfully disagrees**. First, identifying nodes is not the same as the locations of nodes being fixed. Furthermore, Chow clearly teaches the cases that locations of nodes are to be determined, such as “a need exists for the location of the desired sites to be freely located within a service region” (col. 3, lines 4-5).

10. For dependent claims (page 10-12), Applicant’s arguments are not persuasive because they are based on the arguments on independent claims.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jianye Wu whose telephone number is (571)270-1665. The examiner can normally be reached on Monday to Friday, 8am to 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Seema Rao can be reached on (571)272-3174. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jianye Wu/
Primary Examiner, Art Unit 2462